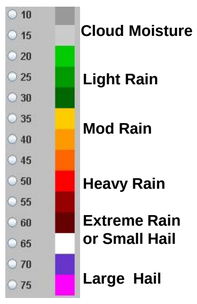
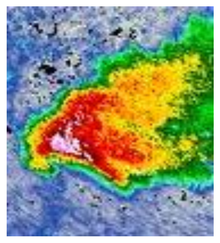
National Weather Service Jacksonville

Interpreting Radar and Satellite Imagery

Doppler Radar Imagery

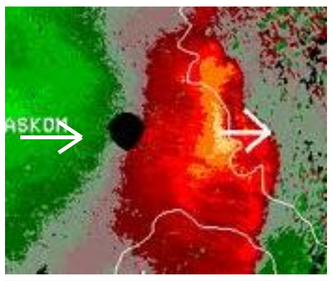
The WSR-88D Doppler Radar detects precipitation targets (most reliably within a range of 250 nm), and can detect boundaries/fronts, insects/birds, and smoke at closer ranges to the radar site.





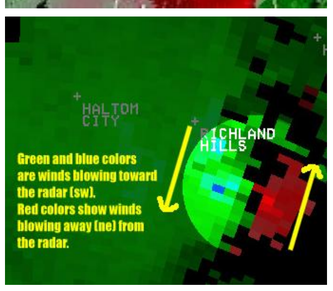
Reflectivity Images

Reflectivity relates to amount of power returned to the radar by target. More power is returned by larger and more numerous targets. So, higher reflectivity relates to larger or more numerous targets.

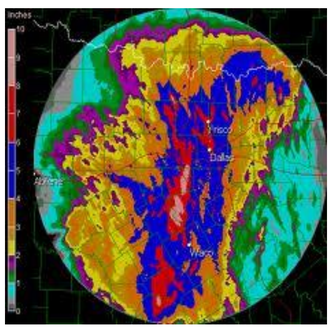


Velocity Images

Velocity images tell us about air flow **relative to the radar site**. So, we need to know where the radar is located to interpret the data. The cool colors (blue, green) indicate where air flows toward the radar site, while warm colors (red, orange) highlight where air flows away from the radar.

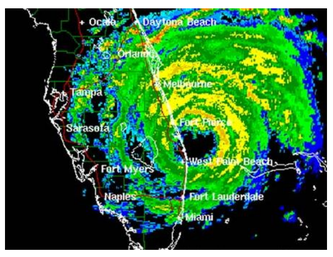


The top image (radar site is black oval) shows strong winds from a thunderstorm east of the radar, while the bottom image shows a circulation associated with a thunderstorm (north of the radar site), often a clue to a tornado.



Rainfall Estimates

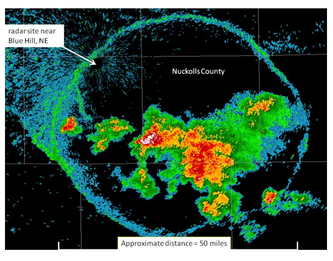
Radar estimates of precipitation amount based on reflectivity values over a given location for a given period of time. This is particularly useful for locating areas where flooding may be occurring.



Interesting Features

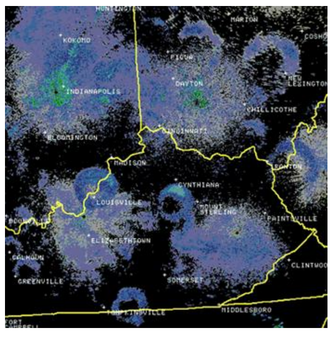
Hurricane rain bands and center (eye). Jeanne approaches Florida.

Sea breeze boundary along western part of the Florida Peninsula (vicinity of Tampa), with t-storms forming along it.



Thunderstorm outflow boundary marks the leading edge of rain-cooled air produced by the storms).

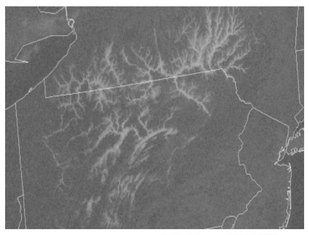
Smoke plume from a fire near Raleigh NC, as detected by Doppler radar.



False echo (large areas of gray), also called “ground clutter”. The rings represent groups of birds or bats taking off at or just before sunrise.

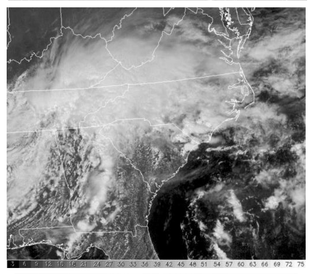
Visible Satellite Imagery

A geostationary satellite takes visible images every 5-15 minutes. These images, which resemble photographs, show light reflecting off the ground, clouds, etc. Since they require sunlight, they are only available during the daytime. At night, they are replaced by infrared satellite imagery.



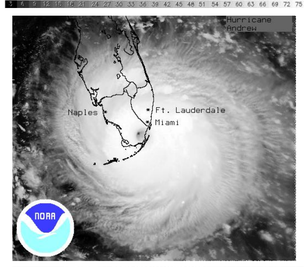
Areas of Dense Fog

Fog appears as gray areas on image, often within valleys and low-lying areas.



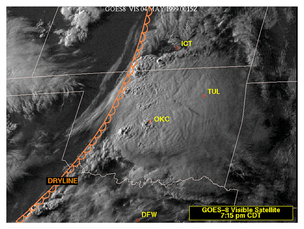
Different Cloud Heights

Various cloud heights can be seen. This image shows mid- and high-level clouds over TN, KY, VA and NC, with lower-level clouds detected over AL, GA and northern FL.



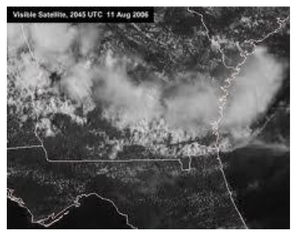
Hurricane

Hurricane cloud patterns are easily seen on these types of images. Hurricane Andrew is shown here.



Thunderstorms, Cloud Shadows

Storm cloud tops are visible, as are the shadows the taller clouds produce when the sun is at a lower angle above the horizon.

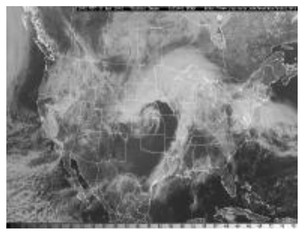


Thunderstorm Outflow Boundaries

Boundaries ahead of rain-cooled air are occasionally visible on satellite imagery.

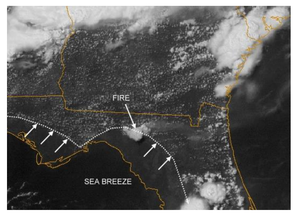
Snow Cover, Low Clouds

This image shows snow cover across the Mid-Atlantic Region, as well as low clouds across WV, MD and western VA. Satellite animations help one distinguish between clouds (that move) & snow cover (stationary).



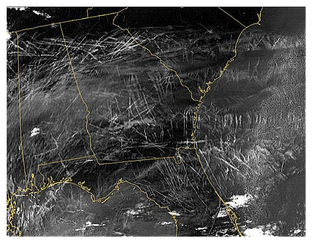
Storm Systems, Fronts

Often, cloud swirls indicate areas of low pressure, with associated cloud bands associated with cold fronts, as seen across the central U.S. on this image.



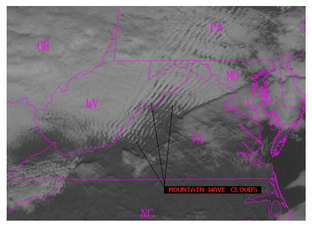
Fire/Smoke, Sea Breezes

Other interesting detectable features on satellite imagery include smoke plumes from fires, and sea-breeze boundaries.



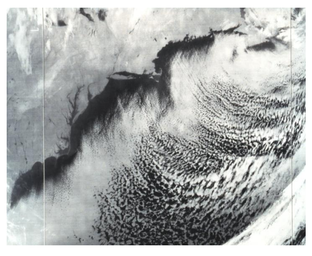
Jet Contrails

Occasionally, the contrails generated by jet engine exhaust can show up on visible imagery, if there is enough moisture aloft to condense and produce the cloud trails.



Wave Clouds (Turbulence)

Turbulent flow can show up at times in the form of cloud waves or bands. This image shows cloud bands as air flows eastward over the Appalachian Mountains.

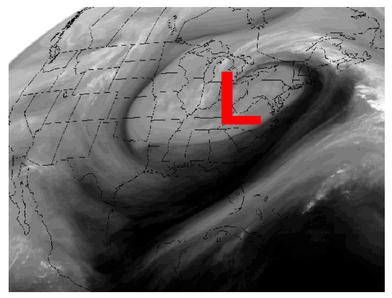


Cloud Streets

Strong vertical wind shear can cause clouds to organize in lines or “streets”. This image also shows the result of cold air flowing offshore over warm water. The drier the air flowing offshore, the greater the distance offshore when the low clouds finally form.

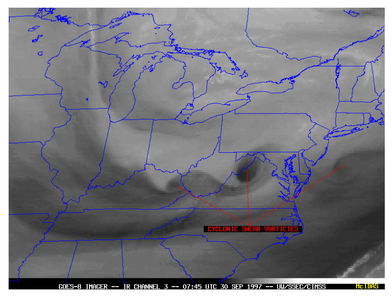
Water Vapor Satellite Imagery

A geostationary satellite takes water vapor images every 15-30 minutes. These images show more than just clouds. They reveal patterns of water vapor in the upper portion of the troposphere. Thus, they can reveal even weak weather systems before they produce any cloudiness or precipitation.



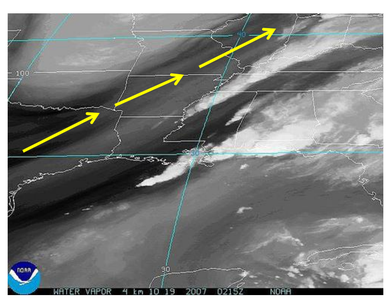
Storm System (Low Pressure)

Water vapor traces the flow aloft, and reveals the existence of swirling flow associated with storm systems. This image shows an intense storm system over the eastern U.S.



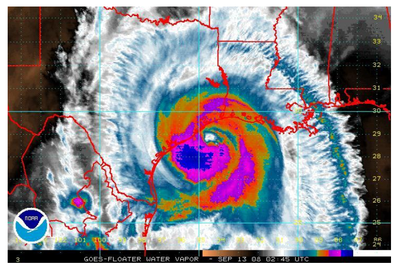
Weak Waves

Weak waves can appear in water vapor imagery, even when there are no clouds with the system to be seen on visible imagery. Here we see a small vapor swirl over northern VA with another over eastern KY.



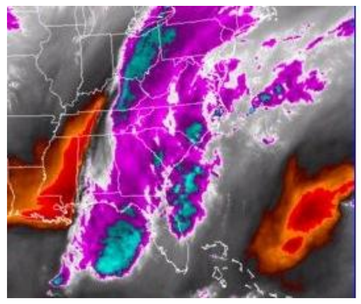
Jet Stream

On water vapor imagery, jet streams appear as long streaks of moisture next to streaks of dry air. On this image, a strong jet stream exists over TX, AR and MO.



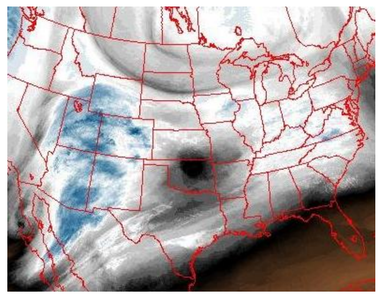
Hurricane

Water vapor imagery can also be used to track hurricanes, and get a sense of the flow pattern ahead of the systems that may help steer them.



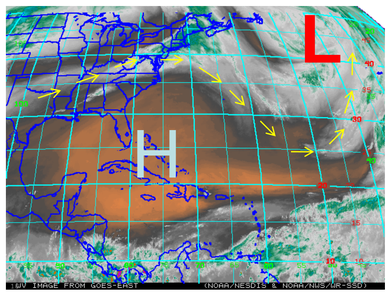
Thunderstorm Clusters and High-level Cloud Patterns

Water vapor imagery shows large swaths of high clouds (eastern U.S. on image), as well as the tops of t-storm clusters (eastern Gulf of Mexico on image). Sometimes it’s hard to tell one from the other (e.g. are the Ohio clouds t-storm tops or general high clouds?).



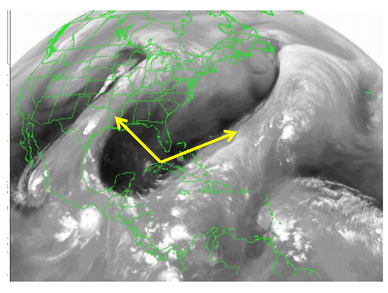
Vertical motion patterns

Water vapor imagery is very helpful for diagnosing patterns of vertical motion, which can lead to clouds & precipitation. Here we see enhanced moisture (white & blue shades) indicating rising motion and cloudiness, along with a darker (drier) area over KS/OK suggesting an area of downward motion.



High and Low Pressure Patterns

Water vapor highlights areas of higher pressure (anti-cyclonically curved flow, over the Southeastern U.S. on image) and lower pressure (cyclonically curved flow, over the north Atlantic Ocean on image).



Moisture Plumes Aloft

Water vapor imagery can illustrate persistent plumes of moisture (whiter bands on image), within which flood-producing rain systems occur.